1 EVALUATION OF RT -MEASUREMENTS

ANLAGE III

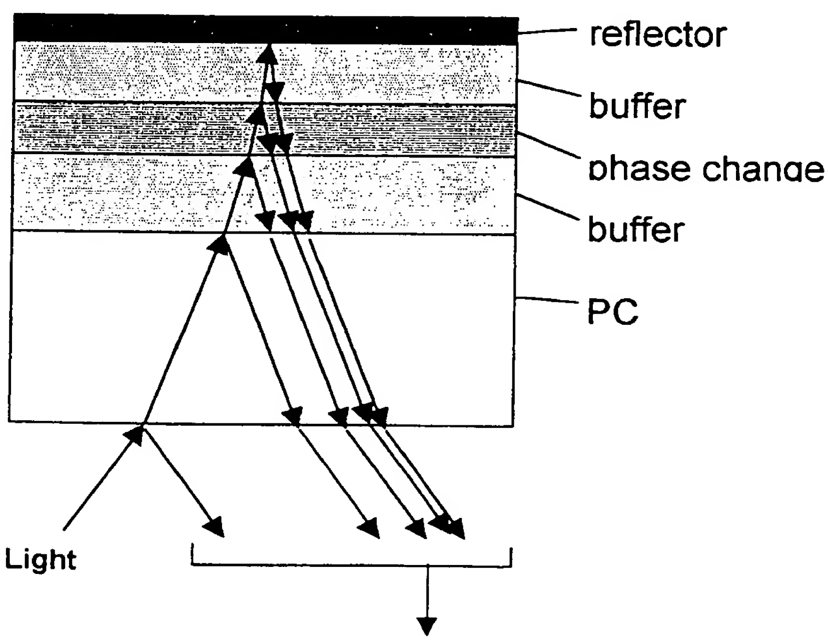
1.1 Contents

In the following overview we briefly will explain our concept of stack reconstruction which means, determination of the material data of all components as well as the layer thicknesses in a whole layer stack, A knowledge of these data is basically needed for quality controll in CDRW-production lines.

1.2 Principle of Layer Stack Calculations

Fig. 1 shows the main concept we use in our software to simulate optical measurements . A light wave coming from the bottom is been partly reflected at the surface of the polycarbonate substrate and partly transmitted. The same happens at each interface of two layers in the stack. Finally the rest of the light will be totally reflected at the metallic layer (Aluminium) and goes back to the polycarbonate. One has to include multiple reflection in order to obtain a good description of the optical response of the layer stack on an incoming light beam. The reflection and transmission coefficients depend on the material parameters as well as the thicknesses and the light wavelenght . So in order to fit layer stack thicknesses first we must know about the material data as a function of wavelength. The ETA-RT-Tester is able to determine theses material parameters in addition to simulation of layer stack thicknesses.

Fig.1



1.3 Determination of Material Data :

What has been done

Single Layers - ZnSiox (used as Buffer-Material in CDRW) of different thicknesses - have been measured, both Reflexion and Transmission Intensity. The fitting times are within the range of about 1 minute or shorter, which depends on the precision needed for the technical application. The method can be used for characterization of new targets or controll of currently used parameters.

Results

By fitting R and T and using an Oscillator ansatz for the dielectric function, we obtained the refractive index of the material, which is about **n =2.1**, and κ **= 0.**

This is in good agreement with data in literaure. The calculated shapes of R and T fit the measured data quite well (Figs.1, 2). After having determined the material data of the buffer layer and of the optical active layer, one is able to fit a full layer stack reflectance.

1.4 Layer Stack Reconstruction

What has been done

The entire layer stack of CDRW has been measured and the measurement evaluated using the material data obtained in the previous step. By a fitting procedure for the Reflectance (the Transmittance is close to zero,in this case, due to the thick aluminium layer), we determined the layer thicknesses of the stack, assuming an Aluminium thickness of 100 nm. The optical behavior is nearly independent of this parameter.

Results

The three fitted layer thicknesses were within the range of the proposed data: For buffer layer 1 on top the Polykarbonat substrate we obtained 83.6 nm, for the active Phase change layer 25.3 nm and for the second buffer layer beneath the reflector 26.0 nm. The good agreement between measurement and simulation is shown in Fig.4.

2 EXAMPLES OF R-T-MEASUREMENTS AND FITS

Fig. 2

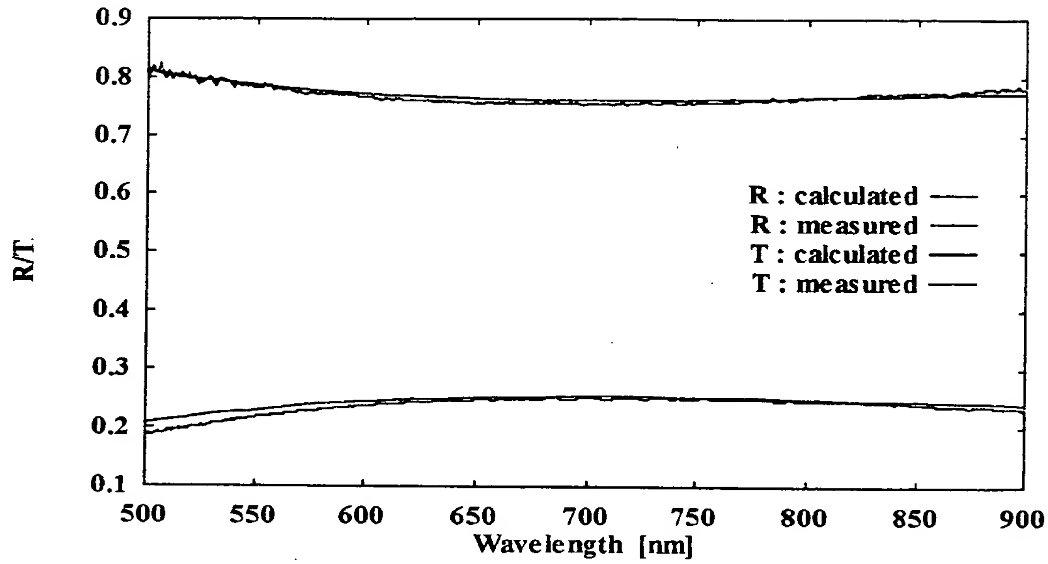


Fig.3

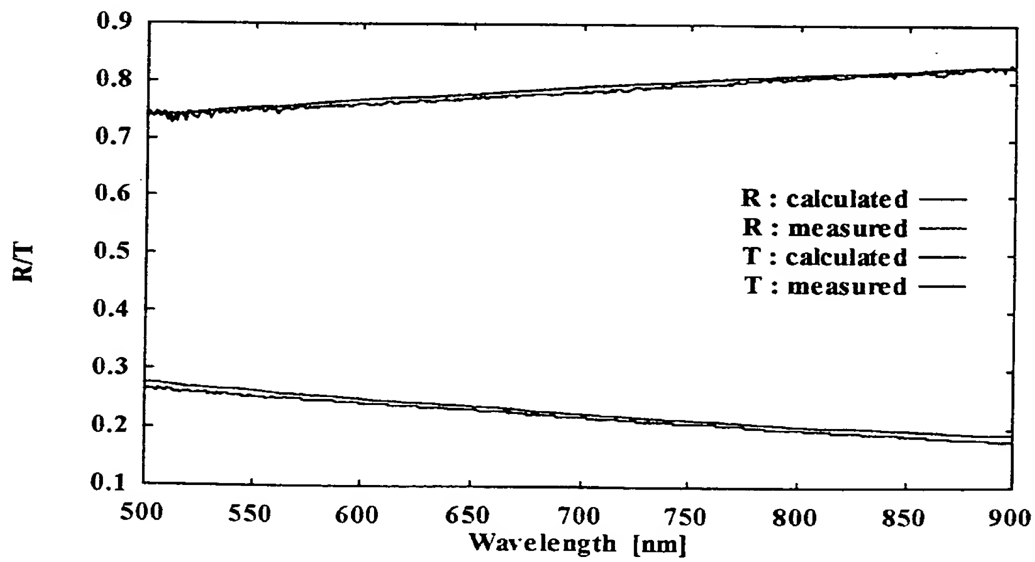
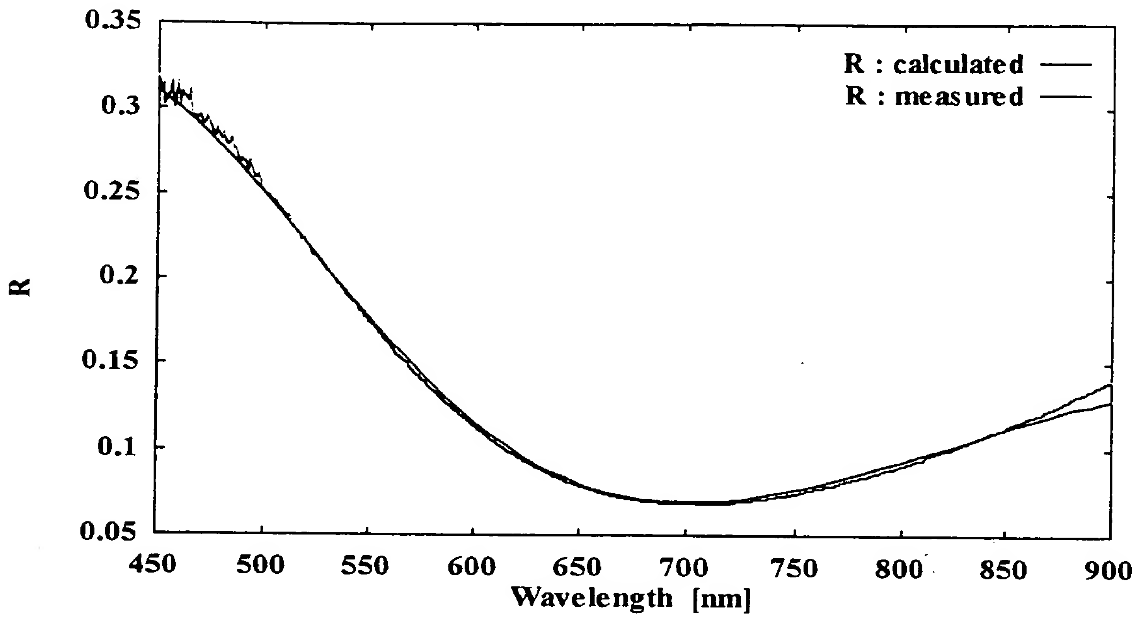


Fig. 4


R : calculated
R : measured
R
0.35
0.3
0.25
0.2
0.15
0.1
0.05
450
500
550
600
650
700
750
800
850
900
Wavelength [nm]